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EXTENSION SERVICE

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Pecans in Texas

Budding, Grafting, Planting and
Transplanting.



Address

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Director and State Agent, College Station, Texas.

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PLANTING PECANS, BUDDING, GRAFTING AND TRANSPLANTING PECAN TREES.

J. A. Evans, Pecan Specialist.

There are various methods of budding and grafting the pecan practiced throughout the pecan belt, all with greater or less success, and it is not intended to assert that the methods hereinafter given are superior to all others. But it is intended to say that these methods have been found, by long experience, to be the most practical and successful at the hands of the writer. And since the three methods here given can be made to cover every case that may arise, it is thought best to deal with these methods only, in order to avoid confusing the beginner.

It will be noted that the various steps in these methods are not only indicated, but to some extent discussed and the reasons therefor given. This is done with the object of stimulating the exercise of the individual judgment of the operator, without which the great work of budding and grafting the pecan trees of Texas will never be accomplished.

MANNER OF TREE GROWTH AND HEALING.

Before entering upon the discussion and illustration of the different methods of budding and grafting it is well to take into consideration the habits and manner of growth of trees, as the processes involved in the operation of growth have to do with the union of scion with stock.

Plants take certain food materials from the atmosphere through their leaves, and certain others, dissolved in water through their roots. This water ascends, not between the wood and the bark, but through the longitudinal cells of the white sap-wood.

These food materials, both those taken from the air and those through the roots, are acted upon in the leaves by sunlight, and are there transformed into available or elaborated plant foods, ready to be appropriated by the tree in its growth. The circulation of these prepared foods is principally downward through certain cells in connection with the inner portion of the bark, which may be clearly demonstrated by wrapping tightly with string or wire a rapidly growing young sprout, and observing that it continues to grow above the wrapping but not below. Therefore, the term "rising of the sap" is not correct, when applied to the semi-fluid material between the wood and bark.

There is a layer of living cells between the wood and bark called the cambium layer.

Every tree before the advent of cold weather, makes a deposit of plant foods with which to start growth in the spring. The first leaves in the spring start from this deposit in connection with the action of the cambium cells, and in turn these leaves become factories to prepare more foods, and so the growth of the tree goes on. Now all union and healing taking place after the operation of budding and grafting is done through the agency of this cambium layer.

By removing a section of bark from a vigorous young sprout in the spring a considerable showing of the cell sap of this layer can be scraped

up with the point of a knife. An exposure to the air for the period of about one minute will turn the mass to a brown color, and an exposure of about two minutes will turn it black. The cells are then dead, and of course a bud placed upon them would not unite.

In the light of the foregoing observations the whole secret involved in the successful operation of budding and grafting can be summed up in the following: **Cambium to cambium, quickly done and tightly sealed.**

SELECTION OF TREES TO BE WORKED.

Constitutional Vigor:

When it has been decided that the pecan trees on the farm are to be worked over, the first step is the selection of the proper trees. In this connection the item of the greatest importance is constitutional vigor. There seems to be no other class of trees that varies so widely among its individual members in their fruit production as does the pecan. Of two trees near each other, budded to the same variety, of the same age, and growing in the same soil, the one may produce only ten pounds of nuts, while the other produces a hundred pounds, all because of inherent weakness in one stock and inherent vigor in the other. Therefore, in the event of choice between a small tree and a larger one, or between a tree in exact position and one a little out of line, let the matter of constitutional vigor be the deciding factor.

Position.

In any deep, fertile soil pecan trees should not stand nearer together than sixty feet each way, while in deep alluvial valley land seventy feet each way is better in the long run. However, trees in a single row might stand much nearer together than sixty feet, as they would not be exposed to competition on all sides. Of course it will not be possible to arrange native trees already growing on the land into perfectly straight rows, but the field should be staked off into squares, and the tree nearest to a stake, size and constitutional vigor being considered, should be chosen. This will fairly proportion the ground area and air space among the trees, and will also, to a greater or less extent, approximate a straight row.

Size.

From small sprouts to trees a foot in diameter marks the practical range of budding and grafting. The larger trees should be preferred over the smaller ones—other things being equal—as they will come into sooner and more abundant bearing.

It is possible to top-work trees that are more than a foot in diameter, but since it is bad practice to cut back branches beyond two or three inches in diameter, the time and expense involved in cutting back, inserting buds, after care of buds, removing sprouts, etc., render the operation impractical.

Shape or Form.

The best height at which to head a pecan tree is some five or six feet above the ground. This will allow room for cultivating under the tree, and will at the same time be low enough to make the gathering of the nuts easy.

In case of choice between two otherwise equally desirable trees, the one heading high and the other branching some five or six feet above the ground, choose the latter.

In case of choice between two otherwise equally desirable trees, the head of one being composed of two or three large limbs, and the head of the other of five or six smaller limbs, choose the latter, unless the size of the former tree is such that its two or three branches are under two inches in diameter. In that case the former tree should be chosen, as requiring less work in grafting.

The reason for choosing smaller limbs is that their ends heal over more quickly after being cut, but this does not enter as a deciding factor below two inches in diameter.

(All the remarks under this heading are intended to be applied to trees of considerable size suitable for bark grafting, and not to small trees susceptible of budding.)

CHIP BUDDING.

The first method of budding in point of season is chip-budding. It derives its name from the small chip cut from the scion and inserted in a notch cut for it in the stock.

The illustration, Figure 1, will make the operation quite clear.

Chip-budding can be successfully done during only a short period, say three or four weeks preceding the rising of the sap in the spring. It is not intended to assert that not a single chip-bud ever set after this period, but it is intended to say that, in comparison with other methods, such a small percentage of union is secured as to render useless its further employment during the season.

The matrix or bed for the chip-bud may be cut at either a node or an internode—that is, at a bud or between buds. The latter place has the advantage of being more likely to result in a smooth cut, as there is generally a gnarl underlying the bud; and as it answers in all other respects just as well, it is best to choose a smooth place between buds.

In preparing the matrix for the bud, use a sharp knife, making a downward cut at an angle of forty-five degrees, extending through the bark and a very little way into the wood. (See figure 1, M.) Next move the knife up some 4-5 to 7-8 inch above this incision (figure 1, N) and make a smooth cut downward, going through the bark and taking a little wood, thus removing the chip.

Next cut a chip bearing a plump, vigorous bud in like manner from a scion, or bud-stick, about the same size as the stock on which the matrix has already been prepared, being sure to get this chip long enough for its new bed (figure 1, C.) If the chip is too long for the bed, the bed can be

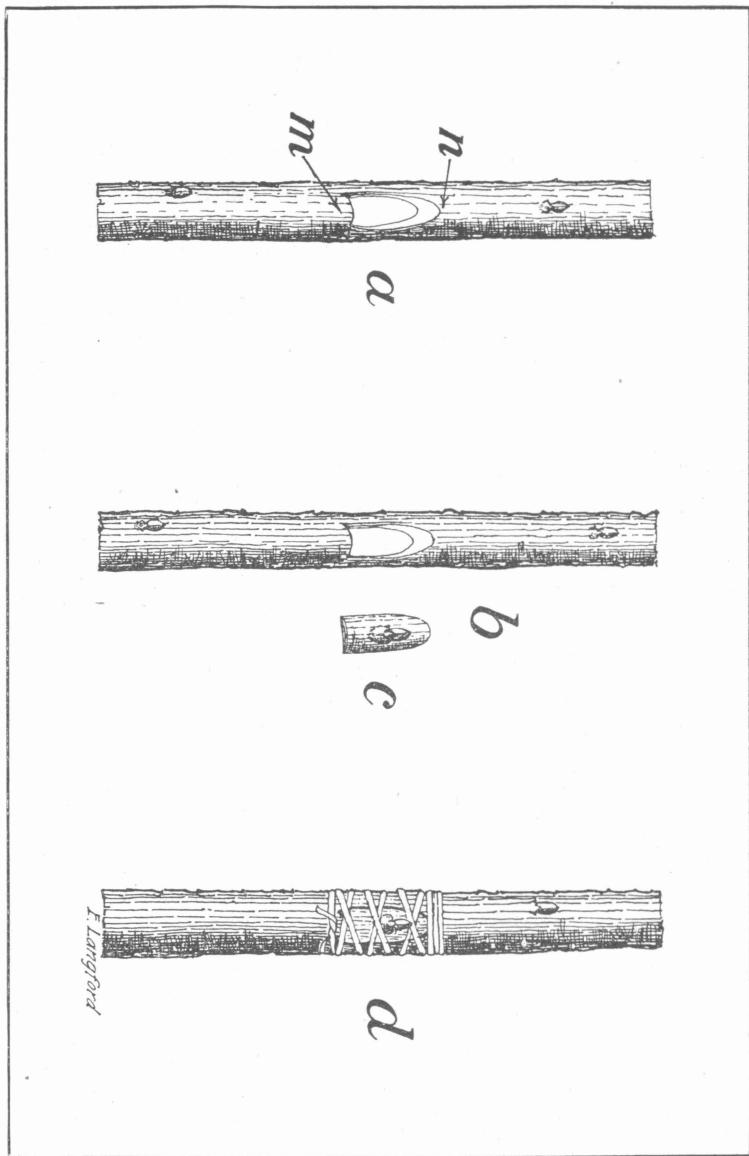


Figure 1—(a) matrix cut in stock for bud; (b), scion with bud (c), which has been cut to fit the matrix (a); (d) bud in place on stock, tied and waxed.

made longer by cutting out; but if the bed is too long for the chip, there is no remedy except by the use of another bud.

After securing a good fit, wrap the bud carefully to the stock, using both hands back and forth, being sure to tie down well at both ends, (Fig. 1, D). After tying, seal well with wax, the formula for which is given on page 30.

Cut away the top of the budded tree anywhere from six inches to a foot above the bud. Since the union in this kind of budding takes place by means of the cambium cells and food deposit already on hand, it would do no special harm to cut back closer than this; but the stub above the bud may serve as a convenient stay to which to tie the new shoot in the event it may show a disposition not to grow upright.

Rub off all native buds on the stub above the inserted bud at the time of budding. As previously stated the union of a dormant bud on a dormant stock takes place by means of the deposit already on hand, unassisted by any foods manufactured by the new growth of leaves, there being no leaves yet. It would therefore be of no advantage to allow the development of new sprouts above the inserted bud. On the other hand the development of such sprouts is likely to prove a distinct disadvantage in that the stock will be disposed to favor the development of its own offspring rather than that of a foster child.

Accordingly, it is repeated, keep all buds rubbed off above the one inserted, even from the very beginning.

It is well, however, except in case of very small trees, to leave some limbs below the inserted bud or to allow the development of some new shoots there. The leaves on this outgrowth will serve as food factories to keep the stock in a healthy growing state until the development of the scion enables it to perform that function.

When the scion has attained a growth of from six inches to a foot in length, the cutting away of these lower branches should begin. They should not all be cut at one time, but gradually, at two or three cuttings, extending over a period of about a month.

Henceforth remove all growth except the scion.

The string binding the chip-bud should not be cut as early as should the string binding the patch-bud. No definite number of days can be stated, since the process of development in different buds is so varied. As a general rule the string should not be cut until its cutting into the bud-chip renders the operation absolutely necessary.

In the process of union the cambium cells form a ring around the edge of the cambium of the bud and the cambium of the matrix or bed; and if the string be cut too soon, this rapidly growing ring will raise the bud out of its matrix, leaving it unsupported save by the yet soft deposit of cambium, thus rendering the new branch an easy victim to wind and accident.

When it is time to cut the string let it be done by passing the knife across the folds of the string on the side of the stock opposite the bud. Do not attempt to unwind the portions of the cut string—leave them alone.

ADVANTAGES AND DISADVANTAGES OF THE CHIP BUD.

The chief advantage of the chip bud lies in the fact that it can be used in advance of the season, before the bark will slip so as to render possible the operation of patch-budding. This advantage is considerable when there is much budding to be done and an early start is necessary.

It also enables the operator to use buds from gnarly bud-sticks, and buds near knots, which buds are not suitable for use in patch budding.

The union from the chip-bud is also one of the best, once secured and matured, and possesses the added advantage of a longer season of growth by reason of its early start.

The chief disadvantage of the chip-bud lies in the delicacy and absolute accuracy required in the operation, rendering a high percentage of living buds difficult to secure, even in the hands of the experienced operator, and in the hands of the novice, next to impossible.

Chip-budding requires that stock and scion be approximately the same size, in order that the cambium in the bud may meet the cambium in the stock. This is a very limiting factor, both in securing buds and selecting locations for them on the stock.

BARK GRAFTING.

This is one of the most important of all the methods of operating the pecan tree, deriving most of that importance from its application to top-working trees too old, too large and too thick of bark to admit of patch budding without first growing new sprouts on which to bud. However, it can be successfully employed on trees of any size, even from the nursery row up—in fact the writer has used it in hundreds of instances in the nursery row, and with entire satisfaction.

The operation can be easily understood by examining the following illustrations, (figures 2, 3, 4, and 5.)

In connection with the subject of bark grafting, certain questions will naturally arise, some of which are here suggested:

1. When should the cutting back be done?
2. How far back on the tree should the cutting extend—that is, how large a branch is it admissible, under best usage, to cut?
3. What should be the condition of these cut-back limbs at the time of grafting?
4. Why should some lower branches be left uncut?
5. What percentage of the limbs should be left?
6. How large a tree can be top-worked?
7. At what point should a limb be cut?
8. Where may scions be obtained?
9. When should scions be got, and how kept pending use?
10. What should be the condition of the scion at the time of grafting?
11. How should a scion be cut for the purpose of inserting?
12. What steps are to be observed in inserting, tying and waxing?

13. What should be the size of a scion, and how many buds should it have?
14. How many scions should be used on a given stock?
15. What after-care should the graft receive?

These questions will be answered in consecutive order:

Cutting Back, When—(1)

The cutting back should be done at the time the buds begin to swell in the spring, or just before this time. If the cutting back be done too early, there will be a dead portion of half an inch or more at the end of the stub, and this dead portion will interfere somewhat with the grafting.

Cutting Back, Size—(2)

Branches should never be cut back beyond four inches in diameter. Two inches and under is better, but in extreme cases it is sometimes necessary to cut to three or even four inches. It should be remembered, however, that the larger the wound the longer it will take to heal; and in case of very large wounds complete healing-over may never take place. In such case, the exposed portion of the end of the cut limb or tree will eventually decay, leaving a hollow. This hollow will catch and retain rain water, leading to further decay, and possibly to the final destruction of the tree. The weakened grafted portion may at any time prove an easy victim to some storm.

Condition of Stock—(3)

The condition of the tree at the time the scion is inserted should be active, that is, the sap should be up. Evidently there will be a certain cavity around the scion, caused by the raising of the bark of the stock when the scion was inserted. This cavity should be quickly filled with new tissue, and the scion built up-to, in order that union may take place. Hence the necessity of the most active condition of the tree. (see v and x, fig. 4.)

Lower Branches—(4)

Some limbs are left below the cut ones to furnish leaves necessary to the health and continued growth of the tree while the new top is being established. They should be cut back the second year, and worked like the ones above, if they are as high as five or six feet above the ground—this being the ideal height to head a pecan tree—but if they are nearer the ground than five or six feet, they should be smoothly cut close to the body of the tree during the winter following the grafting, and the entire growth forced into the new top. Each particular tree, by reason of the infinite variety in form, becomes a subject for consideration, and calls for the exercise of individual judgment.

Limbs Left—Percentage of—(5)

In preparing a tree for top working, about one-fourth of the limbs should be left. This is sufficient to furnish enough leaves to maintain the tree in a healthy condition.

Elsewhere is the statement that bark grafting can be done, not only

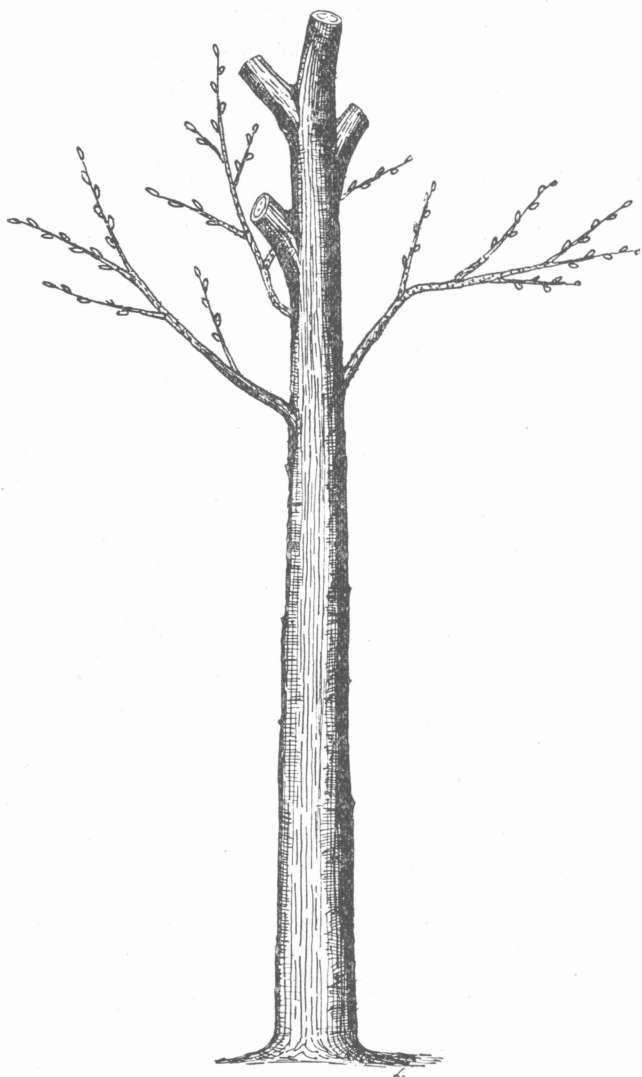


Figure 2—A tree cut back ready for top-working. It is about eight inches in diameter, the lower limbs are about six feet above the ground, and the upper ones some nine to ten feet. The lower limbs will furnish leaves the first year, while the new top is being established. The following year the lower limbs should be cut back and grafted.

in early spring, but also later in the season, under certain conditions (see answer to question 10).

In case of cutting-back for bark grafting after the tree is in full leaf, the entire top of the tree should not be cut away as shown in Fig. 2; but one of the main top branches should be left to bring sap up to the base of the stubs, (a), (b) and (c), figure 5. These stubs should not be too long so as to make the scions too far from the base of supply.

The uncut branch will not only serve to bring up sap, but the prepared plant foods, manufactured in its leaves, will aid the union of scion and stock, and help to heal the wound made in grafting.

In case of any operation on a tree after it is in leaf, it is always better to leave some leaves above the wound.

When the work is done in early spring, and the union of scion and stock takes place by means of the stored plant foods, the leaves of the scion will enable it to perform the necessary functions by the time the stored food supply is exhausted.

Size of Tree—(6)

Answering this question, in the abstract, without respect to the physical and financial limitations, it might be said that any tree, however large, can be top worked.

However, in the case of large trees, the trouble, time, and expense, incident to cutting back the branches to the proper size, and the difficulties encountered in the after care of the grafts, render the operation impractical.

As a general rule trees more than a foot in diameter should not be attempted. This rule, though is subject to exceptions. It often happens that the head of a pecan tree is composed of many small branches rather than a few large ones. In such cases the cutting back can be done without cutting limbs of too large size. It is repeated that each tree requires the exercise of individual judgment.

Cutting Back Point—(7)

How far to cut back limbs from the body of the tree requires the exercise of some judgment. Generally about a foot is a good distance. However, the size and condition of the limb should control over distance. A limb should not be cut where it is too large, and a scion should never be inserted in a curved, gnarly, or knotty place. Select a straight section where the bark is smooth and even.

Scions Obtained, Where—(8)

The following list of Texas growers may not embrace all who are able to furnish propagating wood, but it covers our available list at present:

R. L. Odom of Toledo has the Stuart, Money Maker, Pabst, Van Deman and Tesche; J. T. Fitzgerald of Stephenville has Stuart; W. F. McDaniel of San Augustine has Stuart, Mobile and President; Miss Jennie Lyendecker and

E. J. Brune both of New Ulm, have Stuart, Money Maker, Daisy, James, Delmas, Success, Columbia, Eggshell and Colorado; M. G. Black of Mount Pleasant has the Van Deman and Stuart; Otto Locke of New Braunfels has the Daisy; F. T. Ramsey & Son of Austin has Stuart, Schley, Van Deman, Burkett, Halbert, San Saba, Colorado, Texas Prolific, Pabst, Success, Houston, Money Maker, Mobile, Oliver and others; Doctor A. Caswell Ellis of Austin has Schley, Van Deman, Halbert, Burkett, Pabst, Money Maker, Stuart and San Saba; B. F. Guinn of Rusk has the Money Maker, Schley, Van Deman, Stuart, Delmas, San Saba, Halbert and Pabst; M. Lathrop, Jr. of Marshall has Frotcher, Georgia Giant, Van Deman, Schley, and Stuart; Walter Newton of Jacksonville has Stuart, Taylor, Schley and Van Deman; Clay Folsom of Mound has the Blanchard; H. A. Halbert of Coleman, has Halbert and Stuart; E. E. Risien of San Saba has several Texas varieties.

In addition to the above list many of the nurseries of the state are prepared to furnish propagating wood, but we have no list of them.

It is advised that each one desiring to purchase such wood consult with his nurseryman, who, even though he may be unable to furnish the wood himself, may give valuable information.

Scions Obtained When, and Where Kept—(9)

Propagating wood should be secured during the winter season, not later than the last of February, and should be kept in damp moss or sawdust in cold storage at a temperature of about forty degrees. In this manner it can be carried through the entire summer.

If cold storage facilities are not available this wood can be carried for a considerable length of time by burying it a foot deep in the ground, in a cool shady place on the north side of some building. In this case care should be taken to protect the wood from an excess of moisture. Spring rains are warm, and the added heat and moisture may cause the buds to swell and put out. This is not so bad in the case of buds intended for patch budding as it is in the case of wood intended for bark grafting. For reasons elsewhere discussed it is necessary that the scion used in bark grafting should be absolutely dormant. Wood for patch budding (not for bark grafting) has been successfully carried till the first of June in a box of clean sand set away in a dark corner of the barn. When moisture was needed ice was used instead of water, the whole being kept covered by old papers. Care was taken not to get the sand too wet, as soggy soil of any character is bad for keeping buds.

Speaking generally, the conditions necessary to the keeping of buds outside of cold storage is the presence in only limited quantities of light, heat and moisture. Any contrivance suggested by the ingenuity of him who desires to keep them may be employed to bring about these conditions.

Condition of Scion—(10)

In regard to the condition of the scion to be used in bark grafting the answer must be held to apply to that operation only, and not to the patch-bud, which requires a different condition.

It has been previously stated that the insertion of the scion in the operation of bark grafting will of necessity lift up the bark of stock from the wood, leaving a cavity around the inserted scion. The necessity for the quick filling of this cavity with cambium deposit was also mentioned.

Now, if the inserted scion be the least active, its buds will swell and possibly its leaves put out, necessitating the using up of its own stored food supply; and before the surrounding cavity has had time to fill the scion will wither and die. But if, on the other hand, the inserted scion be dormant, it will require some days of sunshine to effect its complete activity; and during this period the cavity will have completely filled, and union will take place readily.

For this reason the disparity of condition in stock and scion—the complete activity of the one and the absolute dormancy of the other—cannot be too highly emphasized.

Bearing this in mind, work of this character can be done any time during spring and summer, though it is most successful when done in early spring. It should be added however, that scion wood for this work must be carried in cold storage, if carried for any considerable length of time.

Cutting Scion, How—(11)

For cutting scions for bark grafting a sharp knife is necessary, and a blade with a round or budding end is best.

The cut surface should be three inches long, (b, figure 3). A shorter cut exposes less length of cambium at the edges, makes a shorter union, and is more likely to be blown out by the wind.

The surface of the stock is curved, and the surface of the cut on the scion will be flat, if made by a straight blade. It is, therefore, good practice to slightly hollow the cut surface of the scion by passing the rounded end of the blade over it. This will cause the cambium between the wood and bark of the scion to be brought into intimate contact with those cambium cells of the stock which adhered to the wood when the bark was separated from it in the process of inserting the scion.

This precaution is not necessary in case of bark-grafting large limbs, as the divergence between the curved surface of the stock and the flat surface of the scion is so negligible as to be entirely overcome by the pressure of the bark and the binding of the twine; but in case of bark-grafting small limbs and trees, the hollowing of the scion is very important.

In addition to the cut surface on the front of the scion (the side turned to the wood of the stock when the scion is inserted (b, figure 3) it is well to make a slight short cut on the back also, just going through the bark and taking a little wood. (see figure 3, C.)

This latter cut is not absolutely necessary to successful operation in bark grafting, as many unions have been formed without it. There are no statistics showing the comparative percentage of success between its use and the use of the single cut; but referring to the statement concerning the separation of the bark of the stock from the wood in the process of

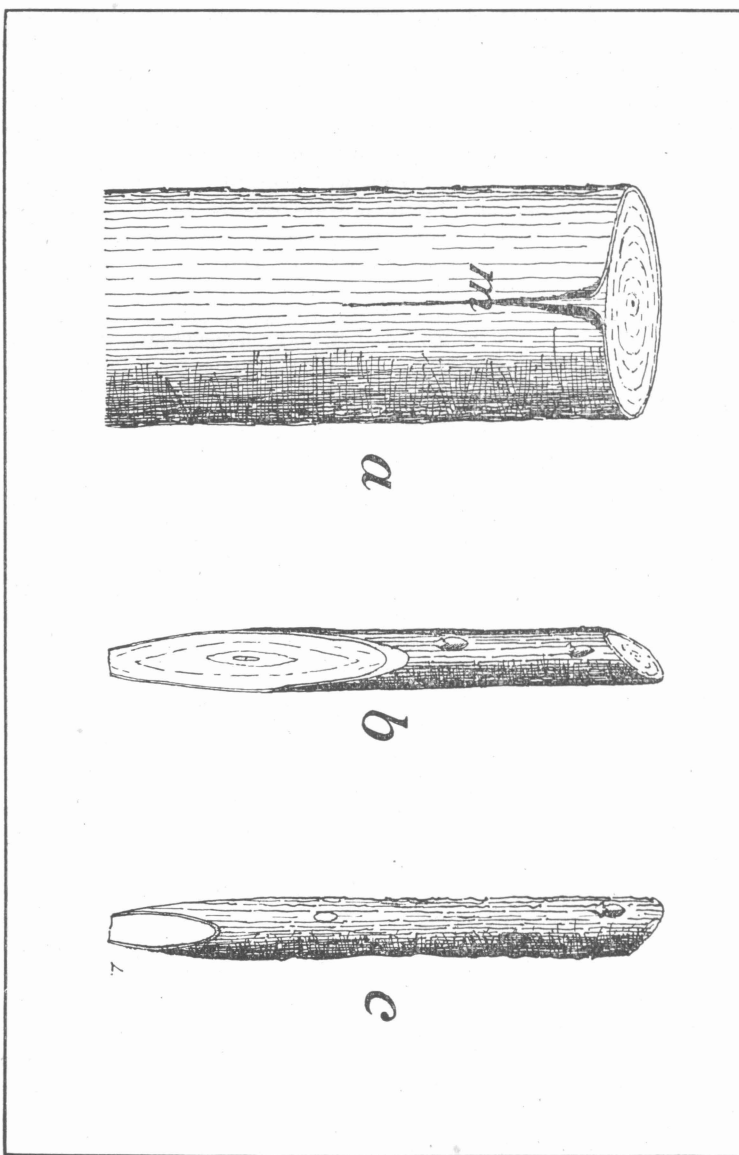


Figure 3—(a) represents a stock two inches in diameter with the bark cut at (m), ready for the insertion of the scion; (b), the front of the scion cut, ready for insertion; (c), the back of the same scion. Note where the buds have been trimmed from that part of (c) to be inserted.

If the bark of the stock (a) is not too thick and tough, the scion should be inserted without making the cut (m).

inserting the scion, some of the cambium cells will adhere to the wood and some will go with the bark. Accordingly it is thought that this short cut with its exposed cambium edges may facilitate the early nourishment of the scion, and also its final union.

Before inserting the scion be sure to trim from the back of it as far as it is to be inserted in the stock, all buds and rough places, so as to secure a clean, smooth surface. This will operate, not only to reduce the cavity around the scion, but also to prevent the lifting of the bark of the stock at a greater distance from the scion—a point to be looked after always.

Inserting, Binding and Waxing—(12)

When the scion has been prepared it may be necessary in some cases, where the bark of the stock is old and tough, to make a longitudinal cut in the bark of the stock, the depth of the cut extending only through the bark. (Fig. 3, M). This cut should be about three inches long, or of sufficient length to accomodate the scion to be inserted. However, it is better in most cases not to make this longitudinal cut, as the bark will then be only partially disrupted by the introduction of the scion, and will be in condition to act as a stronger support to the new growth in preventing its blowing out.

Part the bark very slightly from the wood at the end of the cut limb, introduce the thin end of the scion, and press down gently till the whole of the cut surface of the scion is covered. (Fig. 4).

Close well with wax the opening at the back of the scion, and also all openings at the point of insertion. (See V and X, Fig. 4).

Tie well with strong cord—ordinary wrapping cord of the usual size will not do, except in case of very small trees, as the expansive force of the tree's growth may break it.

After the wrapping is complete use a little more wax in order to make sure that all openings are closed.

There is some question as to which is the better method, to tie before waxing or to wax before tying. The writer has used the former method more than the latter, and still uses it in all cases of small trees and light cord; but in case of large trees and heavy cord the latter method is usually employed.

If the tying be done first, wax well over the strings; if the waxing be done first, see to it that there are no great openings about the back of the scion into which wax will be pressed when applying it, and then further pressed by the tension of the string into the cavity around the scion.

If a neat job has been done, the scion, even before tying, will fit snugly to both wood and bark of the stock; and if this is not the case the tying should be done before waxing.

The Size of Scions and Number of Buds—(13)

There seems to be little limitation as to the size of wood that can be used. In general practice sticks ranging in size from a cigar down to a lead pencil are employed. These sizes, however, do not represent the

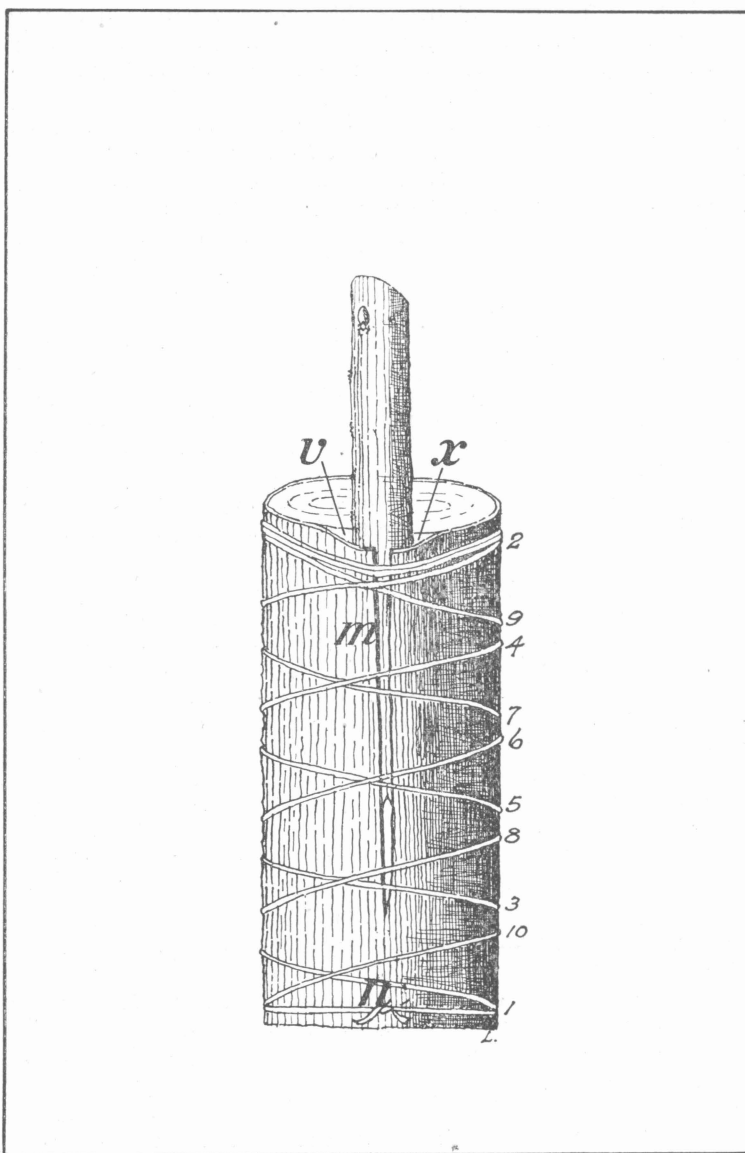


Figure 4—The same stock as shown in Fig. 3 with the scion inserted and tied, but not waxed. It is desired to show the openings at (v) and (x) between the wood and bark of the stock. If these openings are large they should be closed before waxing over, by wrapping a short string of cotton cloth two or three times around the scion, and then waxing. Wrap the string loosely, and do not tie.

The quickest way to tie-in the graft is by beginning at the bottom and going up in ascending spirals, the string coming round at 1, 3, 5, 7, 9, etc.

After taking a round or two at the top, the return route should be by descending spirals, the string coming round midway between the ascending ones, at 2, 4, 6, 8, 10, etc.

The knot should be tied at (n), the place of beginning.

extreme limits of range. The size of the scion bears some little relation to the size of the stock on which it is to be used, though that relation is not definite—in general, larger scions on larger stocks, and smaller scions on smaller stocks.

All newly grown wood with large pithy centers should be discarded.

There should be from two to four buds on the protruding portion of the scion. Theoretically one bud is enough, but to meet the contingency of accident more should be left. However, it should be borne in mind that the greater the protruding portion of scion, the less chance of living. Each of its buds will require to be nourished with water and mineral plant foods through the stock, and if there be too many buds they may die before a good union is effected.

Number of Scions—(14)

A very good rule to govern the number of scions is, one scion for every limb two inches in diameter and under, and one additional scion for every increase of one inch in diameter over two inches. By this rule a three-inch limb would have two scions, and a four-inch limb three scions.

If more than one scion is used in one limb, all the resulting branches, except the best one, should be cut away when the end of the limb (stock) is completely healed over, the extra scions having been intended for no other purpose than to assist in this healing. Several branches arising at the same point will, if left alone, form a crotch of such nature as to render very likely the subsequent splitting out of the limbs by their own weight.

After Care of Scions—(15)

For some days after the grafting has been completed the work will need no special attention, but at the end of the second week the work should be inspected to see if any openings in the wax occur. If any openings are found—which is not likely if the work was well done—retouch the places with wax.

Numerous native sprouts will put out near the end of the cut-off limbs. These should not be removed at once, except those in immediate proximity to the graft. They will serve as a support to the new growth of the scion, and will aid in the formation of new cells. The growth of the graft will be greater by reason of their presence for some time than it would without them. They should be removed by degrees, as the growth and development of the grafted portion enables it to perform the functions of a top with less and less assistance. There is no hard-and-fast rule—one graft will grow more rapidly than another. Generally all native sprouts should be removed by mid-summer.

(If the graft fails to grow—and some of them are going to do that—the best native sprout should be saved and budded by the patch-bud method during the month of July. This bud should not be forced during the current season, but should be left dormant till spring. Late in winter all sprouts, except the one with the bud on it, should be removed and that should be cut just above the bud.

Sprouts of this character, issuing through the thick bark of old trees, are likely to become constricted by the bark at the point of issuance. The

deposit of growth from the new sprout is likely to be on the outside of the bark, rather than in contact and union with the wood of the stock. There will be only a small stem of wood through the bark, joining the limb, outside, to the wood, inside; and when the limb has attained sufficient weight, the stem will break.

To prevent this condition the bark around the place where the sprout issues should be pared thin and some longitudinal gashes cut close to the sprout on either side.)

Four weeks after the date of grafting, rewax all places lightly. The growing of the trees may have caused some cracks or openings, and it is important that these be closed.

The binding cord should not be cut till such action is rendered absolutely necessary by the cutting of the string into the bark of the tree. When such action has become necessary support the new growth by wrapping it to a stay, which may be either nailed or tied to the stock. This precaution should not be overlooked, and the result of all former labors lost in a windstorm.

"What is worth doing is worth doing well," and what is worth doing well is worth following up well. Supporting the grafts may be a little trouble, but it is not the object of this bulletin to tell how to graft pecans without trouble, but rather with its aid.

The union of graft and stock will be very soft at first, and one of the main purposes of the cord is to support the union. Eventually, however, this cord will have to be cut, and with a proper support the cutting may be done sooner. Still it is inevitable that there will be some bending of the scion in the play of the wind, notwithstanding supporting stays, and it is good practice to leave the strings uncut as long as possible.

Immediately following the cutting of the strings there will be rapid expansion at the point of union, and it is at this stage that openings in the wax are most likely to occur. Probably the union will, by this time, be sufficiently developed to render the openings beyond the power of harm, but it is worth while to give them attention once more. If they do no other harm, they will furnish convenient homes for the harboring of insects.

OBSERVATIONS ON BARK GRAFTING.

This system of working the pecan derives its greatest importance from the fact that it saves a year's time in top working large trees. Formerly the limbs were cut back and new sprouts allowed to grow, and these sprouts were later budded by either the ring-bud or patch-bud method. Now the bark-graft is inserted when the limb is cut, and the graft will attain all the size that any sprout would have attained during the season, even though assisted by the removal of its competitors.

The bark graft is also a very successful method of operation—that is, a high percentage of living grafts can be secured if the work be well done, and done under favorable conditions—otherwise it is not at all successful.

This system also possesses the distinct advantage of rendering it

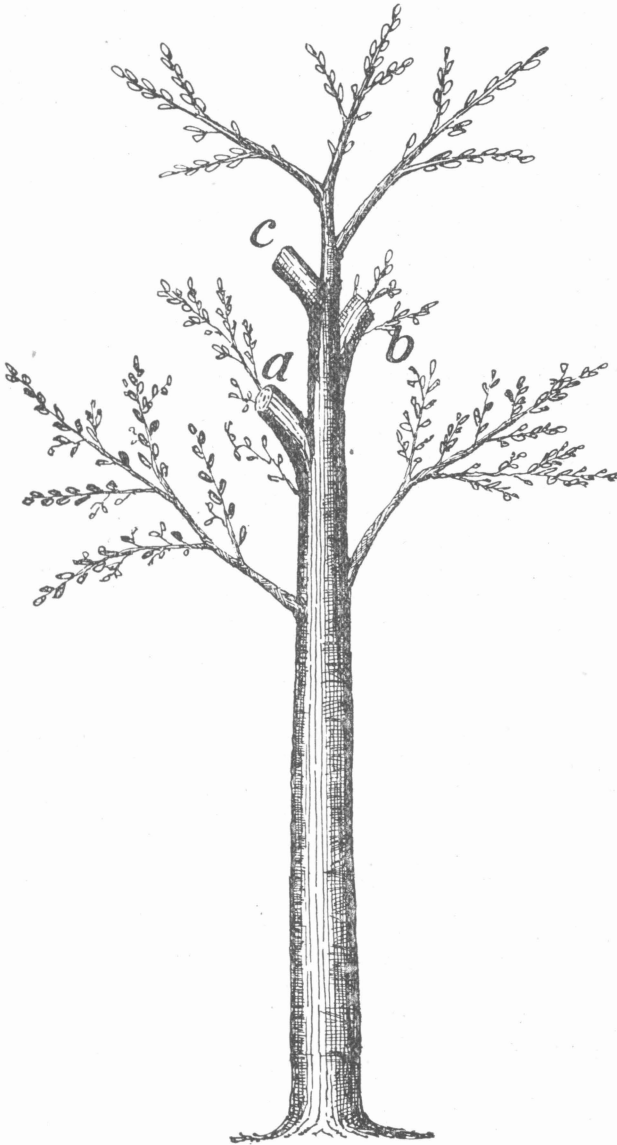


Figure 5—A tree that was cut back for top-working after the leaves were out. Note that one of the main top branches is left uncut. This uncut branch will nourish the scions in the stubs (a), (b), and (c).

Both this top branch and the lower branches should be cut back and worked the following spring.

possible to use almost any character of wood for scions, even old rough gnarly twigs.

The one predominating disadvantage to bark grafting lies in the comparative ease with which the grafts are blown out—hence, the emphasis laid upon the necessity of supporting the new growth by means of props or stays.

In order to prevent this blowing-out, a long slender nail with a flat head driven through the upper portion of the graft and into the stock has been found useful in case of large stocks. The nail should be driven before the graft is either tied or waxed.

The nail does no apparent injury to the graft and is a means of considerable support. However it is not intended to recommend the nail to the total exclusion of all other means. Sometimes a graft will grow eight or ten feet the first season; and a new limb of this size needs support far above the point of union.

PATCH BUDDING.

Taken all-in-all this is the most important of all the methods, either budding or grafting, employed in working pecan trees. It is the same in principle as the ring-bud, the only physical difference between the two being that the ring-bud extends all the way around the stock, while the patch-bud extends only part of the way. The former is open to the objection of requiring the use of buds from scions of approximately the same size as the stocks upon which they are to be placed, which is a very limiting factor in securing good buds; but a patch-bud can be taken from a scion of any size and used upon any stock without reference to its comparative circumference.

The matrix of the patch-bud also presents shoulders or supports against the bark in which the bud is imbedded, which prevents its slipping while the bud is being tied-in. This greatly facilitates and hastens the operation of budding.

For the above reasons, and in consideration of the fact that the patch bud answers in all other respects just as well, there can be no doubt of its general superiority over the ring bud.

A good general idea of patch budding may be had from the accompanying cut, Figure 6.

Concerning the operation of patch budding certain questions will naturally present themselves:

1. At what season can the work be done?
2. What size and age of trees and branches can be successfully budded?
3. What should be the condition of the stock at the time of budding?
4. At what point on the stock should the bud be placed, and should it occupy the position of a native bud removed?
5. What characterizes the best buds for use?
6. How many buds should be used on one tree?
7. What should be the size and age of bud-wood, or scions?

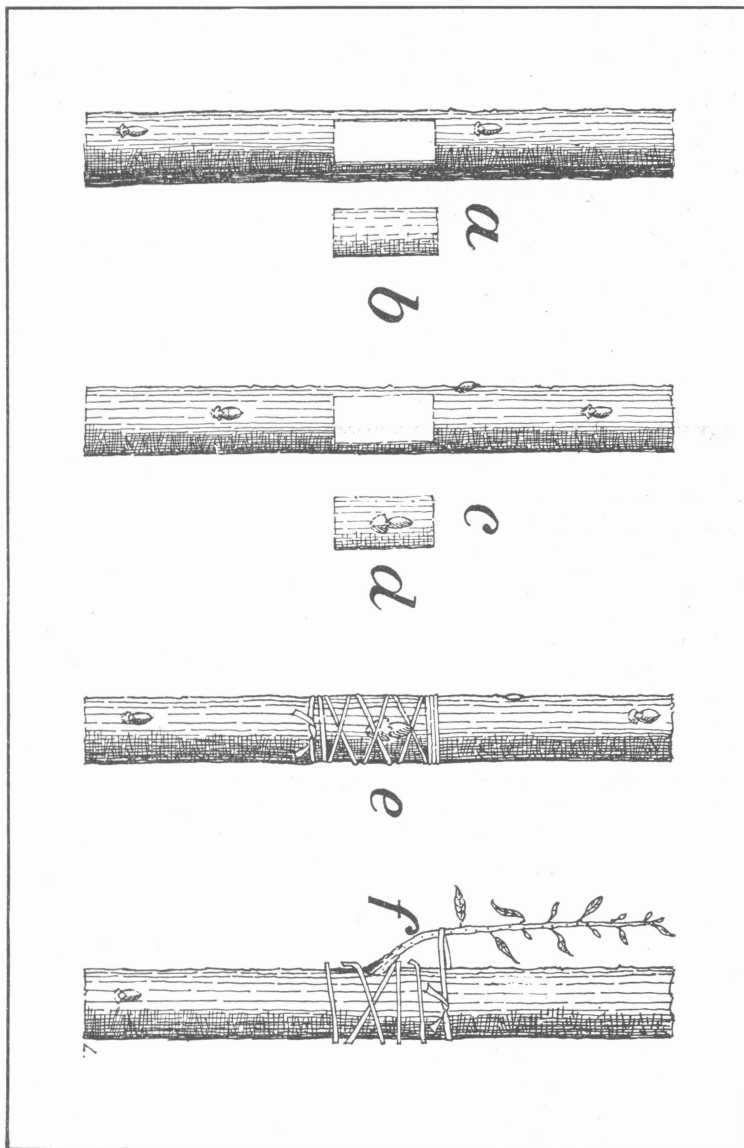


Figure 6—(a), stock with section of bark removed; (b), the section removed; (c), scion with section of bark removed; (d), section of bark containing bud removed from scion; (e), fine bud in place on stock after having been wrapped, tied and waxed; (f), new growth tied to stub of stock left for that purpose.

Note that portions of cut string remain, and that all buds and branches above the scion have been removed.

8. What should be the condition of the wood at the time of budding?
9. How should bud-wood be kept pending use?
10. How long should the removed section of bark be from top to bottom, and also how wide across?
11. What sort of string should be used for tying, and with what force should it be drawn?
12. How much wax should be used in sealing the cut?
13. Should the bud be tied or waxed first?
14. How long before the string should be cut?
15. What after-care is necessary to make the bud put out and continue to grow?
16. What is the best kind of knife for patch budding?
17. What precautions should be observed in transferring the bud from scion to stock?

These questions will be answered in consecutive order:

Season—(1)

This work can be done at any time after the bark begins to slip in the spring until it sets in the fall, though the best time is in early spring. After the first of July buds can be taken from the current season's growth of wood, though such buds are not as good as either storage buds or buds from one and two year old wood on the trees. Buds put on after the first of July should not be forced, but left dormant during the season. This can be effected by leaving the top and all the branches on the stock till winter, when the branches should be removed and the top cut off just above the bud.

This rule of leaving the bud dormant after the first of July will admit of some slight variation to conform to seasonal conditions, principally rainfall. The reason for leaving the bud dormant arises out of the danger that a sprout from it might not attain sufficient size and maturity to go through the winter. But if rainfall has been abundant, and the stock is in very vigorous condition, an early July bud may be forced with reasonable assurance that it will get in condition to withstand the cold.

However, it should be added that nothing will be gained by forcing even under these conditions. The cutting back of the tree in mid-summer sufficiently to cause the putting out of the bud will weaken the tree to such an extent as will more than counterbalance the temporary gain in the new sprout. In short, the dormant bud will overtake the other one the following season.

Size of Stock—(2)

Patch budding can be done on young trees and small limbs from the size of a lead pencil up to three-fourths of an inch, or more in diameter. The limiting factor in budding to large stocks is rather the condition and thickness of the bark than the size of the limb or tree. Usually the bark gets to be thick, rough and corky by the time the tree or limb has grown to the diameter of an inch, and such bark is not suitable for budding.

Doubtless the operation could still be successfully performed if buds could be gotten in the same kind of bark; but long before bark has reached this condition all buds have put out, a few of them making branches, but most of them dropping off.

A necessary condition in patch budding is approximate equality in thickness of bark of stock and scion; but this is so nearly always the case within the limit of one-fourth and three-fourths an inch as to need little consideration within those boundaries.

Generally speaking a patch bud may be placed at any good smooth spot where the bark is not too thick, though it is well to use buds from the oldest sticks in the collection for the large stocks, and buds from the young sticks for the small stocks. In other words try, within a certain measure, to match the bark of scion and stock.

Condition of Stock—(3)

The very best time for patch budding is when the buds begin to swell early in the spring, just as soon as the bark will slip. At this period the new bud has the advantage of being assisted in healing by the first development of the food deposit carried through the winter, soon followed by the flow from the new leaves.

Subsequent to this time, that is, after the leaves are developed and the main process of healing depends upon the circulatory system of the tree, it is sufficient to say that the stock must be in the most active condition.

Elsewhere is the statement that patch-budding can be done from the opening of spring till the beginning of fall. Any limitation upon this statement will be by reason of condition of stock and not by time of year. It would be useless to place buds on a tree when the tree had no "sap" to feed them. Cut a small section of bark from the tree to be budded. If the bark turns loose readily and moisture is plentiful under it the tree is in condition to be budded. If the bark does not slip readily and moisture is scant or altogether wanting, a bud would surely die.

Avoid budding during long summer drouths, and for some days thereafter, unless the stocks be strong vigorous sprouts from the roots of old trees that have been cut down. Such sprouts have such an abundant root system to nourish them that they are generally in good condition long after young trees depending upon their own roots are unfit for budding.

Position of Bud—(4)

The proper position of the bud on the stock depends upon the size, development, and shape of the tree to be budded.

In the growing of nursery stock for use in Texas, the bud should be placed close to the ground. Much difficulty has been experienced in this state in getting nursery trees to grow after transplanting.

The writer has seen acres of trees dying from sun-scald. The bodies of these trees, on the South and West sides, just at the surface of the

ground where they received both the direct and reflected heat of the sun, presented the same appearance as though a wreath of hay had been piled about them and burned. To obviate this condition nursery trees should be severely cut back at the time of transplanting, and earth should be mounded-up nearly or quite to the top of the stub. Now this mounding above the budded portion would be rendered impractical by budding too high.

In case of budding to branches, the bud should be placed near the body of the tree. A bud near the end of a limb will grow another limb, and this will make the combined length too great. Large limbs that would require budding far out, should be operated by the bark graft method; but if no dormant scions are available for bark grafting do not hesitate to remove the large limbs and adopt a small one that can be budded near the body of the tree.

By referring to (Fig. 6, b), it will be observed that the section of bark removed from the stock contains no bud. This is as it should be, and indicates that the bark was removed from an internode, that is between bud and bud. The wood in this position is smooth and even, while there is likely to occur a gnarl and slight projection under a bud, which might injure the bud of the scion when forcibly pressed against it in tying. On nice round young wood near the body of the tree these gnarls do not occur, and it would make no difference whether the bud were placed at an internode or a node; but since the internode answers in all other respects just as well, and at the same time entirely obviates the danger, it is better to adopt it in general practice.

The shape of the limb or sprout to be budded has much to do with the correct placing of the bud. A straight smooth round place should be chosen. A bud should never be placed in a curve unless the bud can be taken from an exactly corresponding curve in the bud stick. Even this is risky, as the eye is not always able to judge accurately, and the effort may result in splitting the bark in which the bud is imbedded, and lead to its ultimate death.

Good Buds—(5)

The best buds are those on the smooth round wood, near the beginning of a year's growth. Buds from near the tip of a limb should be rejected. They usually sit up on a ridge, which causes a hollow under the bud when it is removed. This hollow cannot be pressed down against the wood of the stock, and before it can be filled by cambium deposit the bud will have died.

Good buds can be gotten from two and even three years old wood. On thrifty growing sprouts there are sometimes three and even as many as four buds at a node. The primary one of these buds puts out the first year and drops off. The secondary bud the second year, and so on. This character of bud-wood is very desirable for use on well matured stocks, even when cut from nearby trees and used in summer.

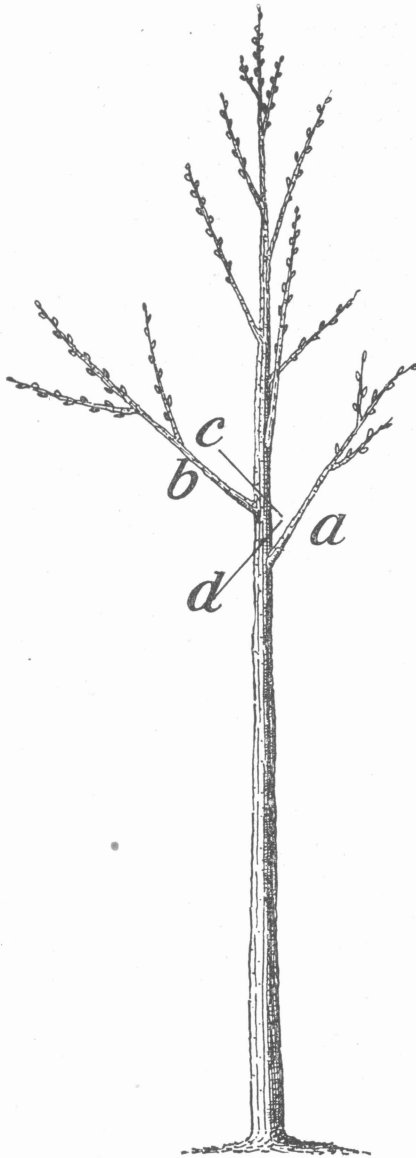


Figure 7—This figure represents a pecan tree two inches in diameter at the ground with the limb (a) four feet above the ground. If several of the limbs were budded, the head of the tree would be formed too low to admit cultivation under it. By budding the limb (a) only, the head can be formed at the will of the operator—that is, the new growth resulting from the bud at (a) can, by pruning, be made to head at any desired height.

If the limb (a) were five or six feet above ground, both it and the limb (b) should be budded, and the head of the tree thus formed.

Number of Buds—(6)

The number of buds to use on a particular tree is largely a matter to be decided by the judgment of the operator, with the tree before him. However, every beginner wants to use too many buds. One bud is enough for any small tree, and is usually enough for any tree up to two inches in diameter, if judiciously placed.

Figure 7 represents a pecan tree two inches in diameter. The limb (a) is four feet above the ground, and is half an inch in diameter.

The beginner would be disposed to bud five or six branches of this tree, whereas it is necessary to bud only one, (a) near the body of the tree, and to force out the bud by cutting off (a) beyond the bud and also removing part of the top of the tree. The following winter the tree should be sawed off just above the branch (a) at (d), and all the growth forced into the new part. The wound will soon heal over, and at the end of two or three years the weight of wood grown from the single bud would equal the combined weight of that grown from six buds, had so many been used. Moreover, much time will have been saved in budding, and much trouble in looking after the buds.

This illustration will suggest some idea of how to take advantage of the various forms, and will tend toward the adoption of the sound motto, "Let the tree do the work."

However, it is not intended to convey the idea that only one bud should be used per tree under any and all circumstances. In case of larger trees several buds can sometimes be used to advantage—only do not use too many.

The writer once had the excess habit, and found that it lost time and entailed trouble.

If the first limb of this tree had been six feet above ground, both the limbs (a) and (b) should have been budded, and the top cut at (c) the following winter. The head would then be formed at the proper height above the ground.

Bud Wood, Size and Age—(7)

Strictly speaking neither size nor age is a limiting factor in the use of bud-wood. Each of these items serves only as an index to condition. Wood can be used for buds as long as any buds remain on it, which is usually two or three years. During this time it rarely attains any considerable size.

Commercial bud-wood is nearly always of the previous season's growth, and ranges in size from a lead pencil to a small cigar.

Condition, Ready for Use—(8)

In patch budding the buds should be used just as soon as the bark on the bud-sticks will slip—the sooner thereafter the better. When put on at this stage considerable healing has time to ensue while the bud is developing from its own food supply; but if the bud is already developed at the putting on, it is likely to die before union can be effected and food supply established. A high percentage of success can not be accomplished with

badly swollen or bursting buds. No doubt it would be better to perform the operation with dormant buds if it were possible.

If the buds on the stick will not slip when desired for use, they can be brought into condition by burying them a day or two in a shallow trench in the ground where the sun can shine on them. If the ground is dry, water the trench with warm water. Do not bury all buds at one time, but only a limited number to be used as needed.

Keeping Bud Wood—(9)

Wood for patch budding should be kept in the same manner as that kept for bark grafting. Reference is made to that article for information.

Length and Width of Bark—(10)

The section of bark taken from the scion, in which the bud is imbedded, should be about seven-eighths inch long and about half inch wide. A somewhat wider bark may be used on a large stock.

The exact length and width are not material.

String—(11)

Some operators prefer raffia for tying-in buds; but ordinary cotton wrapping twine, not too large, seems to answer just as well, and possesses the advantage of convenience. A ball of it can be carried in the pocket, and the desired length pulled out and cut off each time.

In tying-in use sufficient force to make sure that the bark segment of the scion is brought into intimate contact with the wood of the stock.

Wax, How Much—(12)

In sealing the cut, made in budding, only a thin glaze of wax is necessary, just enough to make sure the cut is sealed. There is neither use nor excuse for piles and daubs of it, though if some wax get on the bud it will do no harm.

Order of Tying and Waxing—(13)

Patch buds should first be tied-in and then waxed. It would be impractical to reverse the order. The buds would not stay in place while the waxing was being done. The small binding string can be easily waxed over.

Cutting the String—(14)

The time between the operation of budding and the cutting of the string binding the bud varies with the rapidity of development and growth of the stock. It ranges from two to three weeks. In case of a very active stock, union will probably be effected and the string be cutting into the bark in two weeks, while with a less active stock longer time will be necessary. However, a bud that has not set in three weeks will never do so.

When the strings are to be cut let it be done by passing a sharp knife across them on the side of the stock opposite the bud. Do not attempt to remove the pieces of the string as that may cause openings in the wax.

After Care of Bud—(15)

The attention necessary to forcing a bud out, and particularly to keeping it growing after it is out, varies to such an extent with the condition of the bud and stock at the time of budding as to require some discussion.

Reference is made to the introductory remarks concerning the manner of growth of trees, as those remarks have a direct bearing on this subject. Let it be noted that the leaves are the food factories of a tree, where elaborated plant foods are manufactured to be distributed throughout its system.

Pecan bark will slip before the buds have swollen to any appreciable extent, and it is evident that, in case where a bud is put on just as soon as the bark of both stock and scion will slip, the healing will take place partially through the food deposit, as there are no leaves yet, and possibly will not be for another week or two. Manifestly the portion of the stock above the bud would, under these circumstances, play a less important part than it would had the operation been performed later in the season. However the top will, even in this case, do no harm for some two or three weeks.

As the leaf system develops and the circulation increases, the healing will depend to a greater and greater extent upon the portion of the tree above the bud.

It seems to be common practice in budding to cut back the stock to a foot above the bud at the time of budding, and to also rub off all buds on that portion of the stock.

It would be better, especially in cases where the leaves are already developed at the time of budding, to leave the entire top to assist in healing the wound occasioned by the budding.

When union has fairly started, about two weeks after the date of budding, the top should be cut to the desired length and the native buds rubbed off above the inserted bud in order to force it out. This pruning can be done at the time of cutting the string—the object of the retention of both top and string, the union of bud and stock, having been accomplished.

Why has not a tree as many limbs as it has produced buds? Such would be the case if each bud developed into a limb; but hundreds of buds put out in slender form, turn yellow and drop off, only one here and there developing into a limb where needed.

Now this dropping off, is exactly what is likely to happen to the fine bud if the native ones about it, and particularly above it, are not destroyed—and it is the more likely to occur in that the native buds will in all probability get the start of it.

The object of leaving a foot of the stock above the bud is to use it as a support to which the new growth can be bound in the event it shows a disposition not to grow upright. (See F. Fig. 6).

All limbs below the bud and its resulting sprout should not be removed at one time, but by degrees as the new growth increases its leaves, and is thereby enabled to perform the full functions of a top. If there are many limbs below the bud, cut half of them when the top is cut, and remove the others at two or three cuttings between that time and the middle of June. When not budded before the middle of July neither the top nor the branches of a stock should be cut till the following winter. As soon

as the bud is well set, cut the string and let both scion and stock alone till time for winter pruning.

Budding Knife—(16)

The best kind of knife for patch budding is shown in Figure 8. This particular knife was made by the writer. Two cheap pocket knives with iron handles were purchased at a hardware store. The merchant drilled holes in the handles at the time of the purchase, first placing the knives together and arranging the blades parallel. The knives were then riveted to a block of wood, so the blades would stand exactly parallel and be $\frac{7}{8}$ an inch apart.

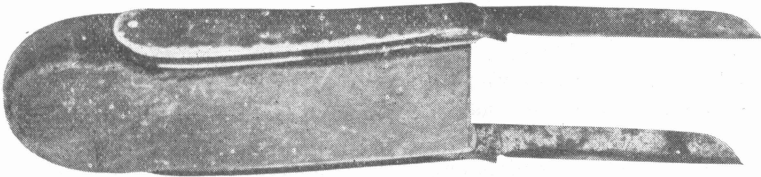


Figure 8—Patch-budding knife.

Similar knives have been made by using ordinary kitchen knives and shoe knives with wooden handles. The handles can be easily trimmed flat and riveted to the block.

The object of having two set blades is to effect a close fit of the bark of scion and stock at top and bottom—the sides are not so important. It will be recalled that the circulation of the prepared foods of a tree is from the leaves downward, principally, and this explains the necessity of an exact fit at top and bottom.

In the absence of a double-bladed knife, patch budding can be done with a single blade; but in this case it is absolutely necessary to have some measure like an old kitchen fork with two tines arranged $\frac{7}{8}$ inch apart, in order to secure a snug fit at top and bottom. This, however, is not entirely satisfactory, as it is slow and slight deviations are likely to occur.

Transferring Buds—(17)

In the operation of patch budding the bark of the stock should be cut first. The corners should be carefully cut so the section of bark will not hang when being removed. Loosen the section to make sure it is clear, but push it back in place quickly to protect the cells under it from exposure while the section is being cut from the scion in like manner. When the latter section has been cut and thoroughly loosened, flip out the section from the stock and make the transfer of the other quickly. It is well to have the string ready, as otherwise the bud may fall out while the string is being prepared.

VARIETIES OF PECANS.

The question is often asked "what are the best varieties of pecans for

Texas?" This question can not be given specific answer. Texas possesses in its various parts all the climatic conditions to be found in the South.

The several varieties have been tested out in very few parts of the State, and therefore the best of all foundations for assertion, that of actual demonstration, is lacking.

However, the state may be divided into two general divisions, and some suggestions offered as to each.

The first division embraces East Texas and a belt about one hundred miles wide along the coast, extending west as far as Victoria county.

In this territory it is safe to use varieties that originated in humid climates, such as Stuart, Frotcher, Delmas, Pabst, Schley, Russell and others. There is a saying that the pecan hates to be moved east; and it is generally true that varieties originating in the semiarid west scab badly when transferred to a humid climate.

The second division extends west from Dallas to Taylor county, and south to San Antonio and beyond.

The climate of this section is radically different from the former. Some of the finest pecans in existence are to be found here, and their use as scions throughout the territory cannot be too strongly urged. Some of these varieties have already been introduced to the public, such as the Halbert, Burkett, Oliver, San Saba Improved and others.

Neither this nor the former list is intended to be exhaustive, but only suggestive—nor is it to be supposed that the line of demarkation is clearly defined between the two sections so imperfectly outlined.

In connection with the selection of varieties for either section the writer desires to call attention to the fact that entirely too much attention is paid to the size of the pecan. There is no use in raising very large pecans unless there are enough of them to amount to something. A hundred pound sack of fair pecans is worth more than five pounds of fancy ones.

In any scale of estimating the value of any particular variety, the item of regularity and heaviness of bearing ought to count for fifty per cent at least.

Almost every community in the pecan territory of the west has one or more trees with established reputation for fair nuts and heavy yield, and these trees should not be overlooked as a source of scions.

Of course it is not intended to suggest that all trees in the community be worked exclusively to local kinds, but the fact that certain trees do well in a locality demonstrates that they are adapted to the environment, and suggests that some trees should be so worked in the interest of certainty.

Experience has demonstrated that the budded trees will bear quite as well as, or even better than the original tree from which the scions were taken.

RECIFE FOR BUDDING AND GRAFTING WAX.

Rosin two parts, beeswax one part.

Melt together and set off to cool, stirring occasionally.

Just before the mixture is cool enough to solidify, which can be told by its beginning to stick to the sides and bottom of the vessel, pour in alcohol slowly, stirring all the while. Continue to add alcohol till the whole mass has turned a golden yellow color, and has reached the consistency of mush.

If more alcohol be added than required to saturate the mixture, it can be poured off; though there is no need of adding too much, if the above directions be observed.

Grain alcohol is preferable, though wood alcohol will do.

SETTING OUT OR PLANTING, WHICH?

The question is frequently asked whether it is better to set out a given area to budded nursery stock or to plant nuts with the ultimate object of budding the young trees when they shall have attained sufficient size.

The former method has the advantage of saving some two years of time, and, at the end of ten or twelve years the two additional crops will have more than counter-balanced the item of expense.

The latter method possesses the advantage of immediate economy; and if funds are not available for buying and transplanting trees, by all means plant nuts, and bud the trees later.

To him who objects that it will take so long to grow a bearing pecan tree, two answers can be made:

1. No one waits so long as he who does not start at all.
2. You will have to wait whether you grow them or not.

PECAN SCIONS ON HICKORY STOCKS.

The methods of budding and grafting pecan scions to pecan stocks, herein described, will apply to budding and grafting pecan scions to hickory stocks and also to English walnut scions to black walnut stocks.

The question is often asked, "Will it pay to use the hickory as a stock for the pecan?"

The pecan is a thrifty grower, and the writer is of the opinion that it will not pay to use pecan scions on dwarf hickories—the top will outgrow the stock—but there is little doubt that the pecan will do very well on the larger and more thrifty-growing varieties of hickory.

The same reasoning will apply to English walnuts on our native stocks—only the very largest varieties of the black walnut are capable of nourishing a top of that rank-growing tree.

PLANTING PECANS.

Select large nuts from a vigorous tree—not because these nuts will reproduce themselves, for they will not, but because a large nut contains more meat than a small one, and this meat will be used as food by the young plant, thus insuring a more vigorous start in life.

By the first of December place the nuts in water and float out all immature ones. Stratify the remainder as follows: Place three inches of sand in an ordinary goods box. Next place a stratum of nuts and cover with two or three inches of sand. Keep the box on the ground anywhere about the yard, but see to it that chickens do not scratch the nuts out. Keep the sand in the box moist, not wet, just an ordinary "season."

In March, just before germinating time, remove the nuts and plant as you would plant beans or other seed. Practically every nut will come up; but it is well to remember that a young pecan tree will die the first summer if in a dry place and left uncultivated and unshaded.

Fairly good results can be secured, also, by planting nuts in the fall where they are intended to grow; but success should not be expected from planting dry nuts in the spring.

TRANSPLANTING PECAN TREES.

It will be noted that this article deals with transplanting pecans in Texas. Other methods may be successful in more humid regions, but experience has demonstrated that throughout the greater part of Texas a high percentage of living trees can be secured only by the following methods:

Dig the holes $2\frac{1}{2}$ by 4 feet and at least 3 feet deep. Of course, holes 3 feet square will do, but they will be harder to dig. If the bottom of the hole be in hard dirt, go down two or three feet more with a drop or punch auger, and dynamite. In digging be sure to place the good dirt on one side of the hole and the poor dirt on the other.

Take the trees to the place of transplanting in the original package. Remove one tree at a time, as needed, being sure to keep the roots of the others covered with wet sacks so as to prevent drying of the roots. Cut back with a sharp knife all bruised, broken, or rotten parts of roots. Set the tree one inch deeper than it stood in the nursery row.

Let one man get in the hole with the tree while another shovels in the dirt, the good soil next to the roots and the poor soil into the corners. The man in the hole should be careful that the lateral roots do not get pressed down around the tap root, but that they extend horizontally as nature placed them. Continue the operation till the roots are all covered and the hole nearly full. Pour in two or three buckets of water to settle the dirt around the roots, and finish with dry dirt, packing it down.

It must be borne in mind that the greater portion of the roots of a pecan tree were of necessity cut off in digging, and the top must be cut back in even greater proportion. Therefore cut the tree back to within some six buds of the budded portion, and hill up dirt around it nearly or quite to the top. Do not allow grass and weeds to grow up around it or the ground to bake. Cultivate occasionally, and it will live. Several sprouts may come out; select the best one, and cut away the others.

Do not worry over the necessity of cutting the top. A small young thrifty top is better than a large dead one.

Transplanting may be done any time from November till March—the earlier the better. Care should be taken that the roots be not allowed to freeze between digging and transplanting.

The proper distance between trees depends largely upon the nature of the soil. If the soil be neither very deep nor very fertile fifty feet each way is sufficient, if the trees are planted in squares. In soils of greater depth and fertility sixty feet each way is about right. In very deep alluvial valley soils, they should be seventy feet apart. If trees are set in a single row, much shorter distances will do.